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WHAT IS CLAIMED IS:

1. A process for producing a barrier film which comprises the steps of:

providing a substrate in a vacuum atmosphere;

5 introducing a feedstock gas having a high temperature-melting point metal in its structure and a reductive nitrogen-containing gas comprising a nitrogen atom into said vacuum atmosphere; and

10 forming a thin film of the nitride of said high temperature-melting point metal on said substrate;

wherein a nitrogen-free auxiliary reductive gas is introduced into said vacuum atmosphere.

15 2. The process for producing a barrier film according to claim 1, which comprises a step of introducing said auxiliary reductive gas together with said feedstock gas and said reductive nitrogen-containing gas into said vacuum atmosphere.

20 3. The process for producing a barrier film according to claim 2, which comprises a step of introducing said feedstock gas and said reductive nitrogen-containing gas into said vacuum atmosphere without introducing said auxiliary reductive gas.

25 4. The process for producing a barrier film according to claim 2, wherein, in the step of introducing said auxiliary

reductive gas together with said reductive nitrogen-containing gas and said feedstock gas,

5 said reductive nitrogen-containing gas is introduced at a flow rate once or more higher than the flow rate of said feedstock gas, and said auxiliary reductive gas is introduced at a flow rate once or more, but not more than 10 times higher than the flow rate of said reductive nitrogen-containing gas.

10 5. The process for producing a barrier film according to claim 1, wherein, in the step of introducing said auxiliary reductive gas together with said reductive nitrogen-containing gas and said feedstock gas,

15 said reductive nitrogen-containing gas is introduced at a flow rate once or more, but not more than 5 times higher than the flow rate of said feedstock gas, and said auxiliary reductive gas is introduced at a flow rate 2 times or more, but not more than 10 times higher than the flow rate of said reductive nitrogen-containing gas.

20 6. The process for producing a barrier film according to claim 2, wherein, in the step of introducing said auxiliary reductive gas together with said reductive nitrogen-containing gas and said feedstock gas,

25 said auxiliary reductive gas is introduced at a flow rate once or more, but not more than 15 times higher than the flow

rate of the feedstock gas having said high temperature-melting point metal.

7. The process for producing a barrier film according to
5 claim 1, wherein, in the step of growing the thin film of the
nitride of said high temperature-melting point metal,¹³

a diluent gas not reacting with said high temperature-melting point metal and a gas having an oxygen atom in its chemical structure are introduced so that the pressure of said
10 vacuum atmosphere is regulated to 1 Pa or more, but not more than 100 Pa.

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8. A process for producing a barrier film for forming a barrier film made of a thin film of the nitride of a high
15 temperature-melting point metal on a substrate, wherein;

the surface of said substrate is exposed to a plasma of hydrogen gas and a plasma containing at least one gas selected from among argon, nitrogen and helium gases, and then the thin film of the nitride of said high temperature-melting point metal
20 is formed on the surface of the substrate.

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9. A barrier film comprising a thin nitride film of a high temperature-melting point metal, wherein,

said thin nitride film has a content of said high
25 temperature-melting point metal exceeding the stoichiometric

composition ratio thereof.

10. A barrier film comprising a thin nitride film of a high temperature-melting point metal formed on a substrate and
5 aiming at preventing the diffusion of metals in an interconnecting thin film formed on said thin nitride film,
wherein,

said thin nitride film is free from silicon.